MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2016/2017

PPC0016 – PRE-CALCULUS

(All Sections / Groups)

13 OCTOBER 2016
9.00 a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This examination paper consists of **4 printed pages** (including the cover page) with **4 questions only**.

2. Each question is worth **25 marks. Attempt ALL questions.**

3. Please write all your answers in the Answer Booklet provided. **Show all relevant steps** to obtain maximum marks.

Question 1 (25 marks)

(a) Express the following complex number in standard form (a + bi):

$$\frac{1}{1-i}+\frac{1}{5+3i}$$

[4 marks]

(b) Solve the following equations and inequality:

(i) $1-3x^{-\frac{1}{2}}+2x^{-1}=0$ [5 marks]

(ii) $\sqrt{1+\sqrt{x^2-1}+\sqrt{x+1}}=1$ [5 marks]

(iii) $\frac{1}{3x-1}+\frac{1}{x+1}\geq 1$ [5 marks]

(c) A box can be made by cutting out the corners and folding up the edges of a square sheet of cardboard. A template for a cardboard box with a height of 2 cm is given in Figure Q1. What is the length of each side of the cardboard sheet if the volume of the box is to be 50 cm^3?

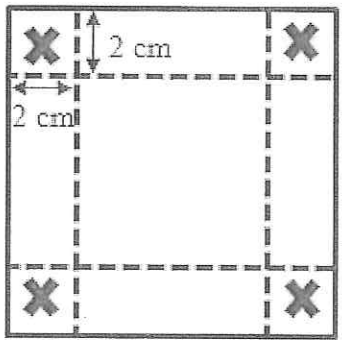

Figure Q1

[6 marks]

Question 2 (25 marks)

(a) Determine the equation of the line that passes through the point (−1, 5) and is perpendicular to the line given by $\frac{1}{5}y-\frac{2}{3}x-1=0$ [5 marks]

Continued...

(b) Given $f(x)=x(x-1)(x+1)$,

(i) Find the x-intercept(s) and y- intercept(s) of the graph of f, if any. [2 marks]

(ii) Find the intervals on which $f(x)$ is increasing and/or decreasing. [2 marks]

(iii) Determine the end behaviour of the graph of f. [1 mark]

(iv) Determine the maximum number of turning points on the graph of f. [1 mark]

(v) Determine the behaviour of the graph of f near each x-intercept. [3 marks]

(vi) Sketch the graph of f. [3 marks]

(c) Solve the following equations:

(i) $2^{x^2+1}=8$ [4 marks]

(ii) $\log_2(x+1)-\log_2 x=\log_2(x-1)$ [4 marks]

Question 3 (25 marks)

(a) Use long division method to perform the division for $f(x)=\dfrac{3x^4-2x^2+4x-3}{(x+1)(x+2)}$ to find the quotient and remainder. [6 marks]

(b) Use the Factor Theorem to show whether the followings are the factors of $f(x)=2x^5+3x^4-30x^3-57x^2-2x+24$.

(i) $x-4$ [3 marks]

(ii) $2x+3$ [3 marks]

(c) Given a function $f(x)=2x^7-52x^4+2x^3-22x^2-5$, use synthesis division method to find the remainder if $f(x)$ is divided by $x-3$. Use the Remainder Theorem to verify the answer. [5 marks]

(d) Given the rational function

$$f(x)=\frac{4x^2}{(x-1)(x^2-4x+4)},$$

use partial fraction decomposition to show that it can be written in the form

$$f(x)=\frac{4}{x-1}+\frac{16}{(x-2)^2}.$$

[8 marks]

Continued...

Question 4 (25 marks)

(a) A smartphone shop sold 200 phones in the year 2008. Each year thereafter, the shop sold 20 more smartphones than the year before so that the shop sold 220 in 2009, 240 in 2010 and so on.

(i) Find an expression, in terms of n, for the number of phone sold on the nth year. [2 marks]

(ii) Calculate the total number of phones the shop sold from 2008 to 2014 inclusive. [2 marks]

(iii) In the year 2008, the selling price of each smartphone was RM 1440. However, the selling price fell by RM 90 each subsequent year, so that in 2009 the selling price was RM 1350, in 2010 the selling price was RM 1260 and so on. In a particular year, the selling price of each smartphone in RM was equal to two times the number of smartphones sold in that year. By forming an equation, find the year in which this occurred. [4 marks]

(b) A geometric sequence has the first term a and common ratio r. The second term of the series is 8 and the sum to infinity of the series is 40.

(i) Show that $5r^2 - 5r + 1 = 0$. [4 marks]

(ii) Find the two possible values of r and the corresponding two possible values of a. [2 marks]

(iii) If r takes the larger of its two possible values and a_n is the n-th term of the geometric sequence, find the smallest value of n for which $a_n < 2$. [5 marks]

(c) (i) Find the first 4 terms of the binomial expansion, in ascending powers of x, of $(1+x)^8$. [4 marks]

(ii) Using the binomial expansion in (c)(i), approximate the value of 1.025^8, giving your answer to 4 decimal places. [2 marks]

End of Paper